Simulating Dissolved Organic Carbon (DOC) Transport with Delta Simulation Model (DSM2)

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Delta Modeling Section

Outline

- Background

- Past DOC simulations

- Summary

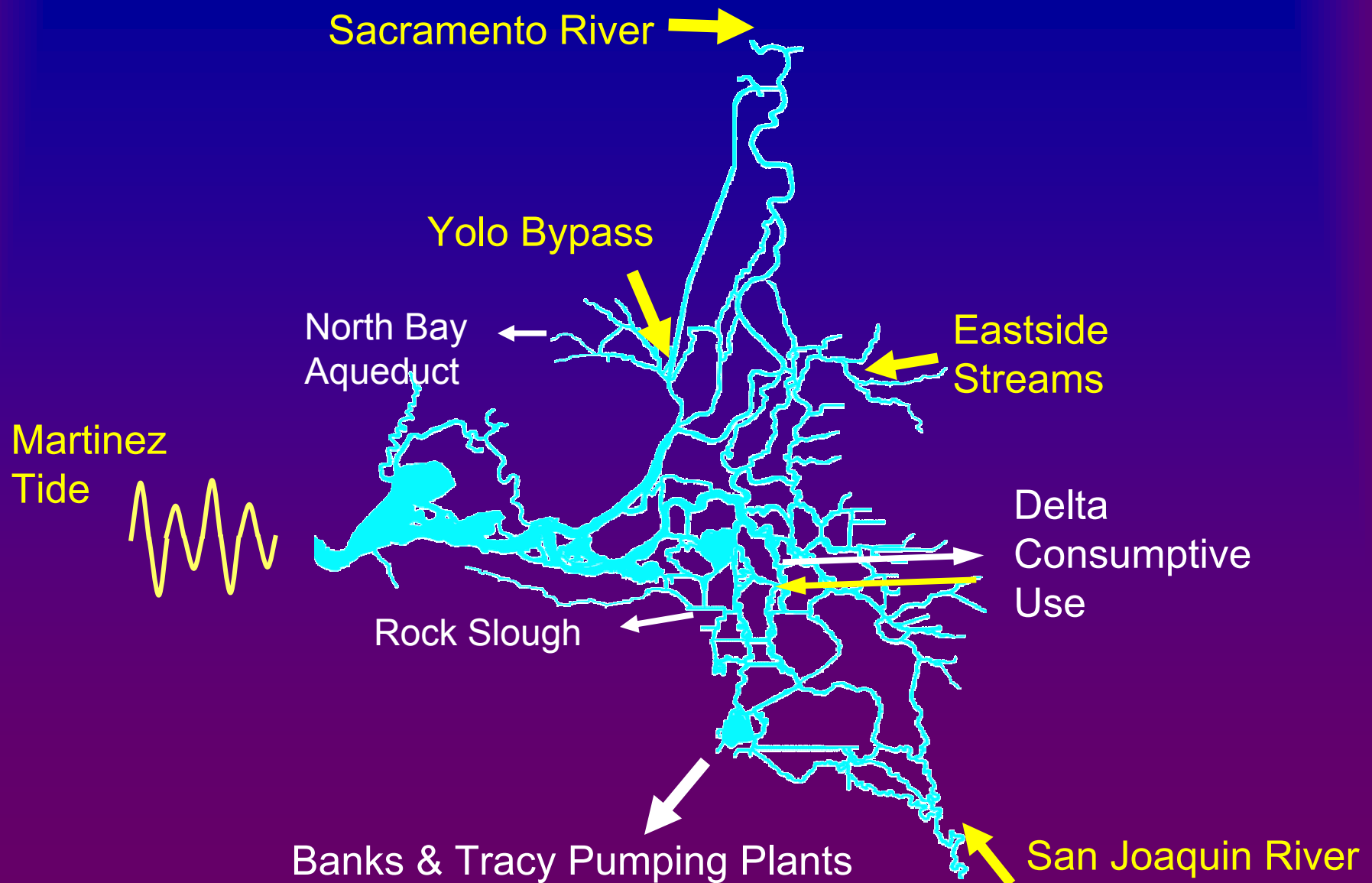# Why Simulate Organic Carbon?

Drinking Water Concern:

During the treatment process, Chlorine reacts with Organic carbon to create disenfection by-products called THMs that may be cancer causing.

Past Calibration/Validation Effort

- DSM2 recalibrated and validated in 2000 in a multi-agency effort under IEP

- Focus: Flow, stage, EC throughout the Delta

- Results available on the IEP Web-site:

- *http://www.iep.water.ca.gov/dsm2pwt/dsm2pwt.html*

Boundary Conditions

Sacramento River

Yolo Bypass

North Bay Aqueduct

Eastside Streams

Martinez Tide

Delta Consumptive Use

Rock Slough

Banks & Tracy Pumping Plants

San Joaquin River

Typical DSM2 Water Quality Simulations

- Minerals (EC, TDS, Br, Cl, etc.)

  Main Source is the ocean

  Peak values at periods with low NDO

- Organics (DOC, UV, etc.)

  Land based

  Peak values during storm events

DSM2-Qual
(Data Needs For DOC Simulation)

- Hydrodynamic results from DSM2-Hydro

- Channel geometry

- DOC boundary concentrations for all the flow sources entering the Delta

Assumptions

- DOC acts as a conservative constituents

- No other DOC source in the river bed

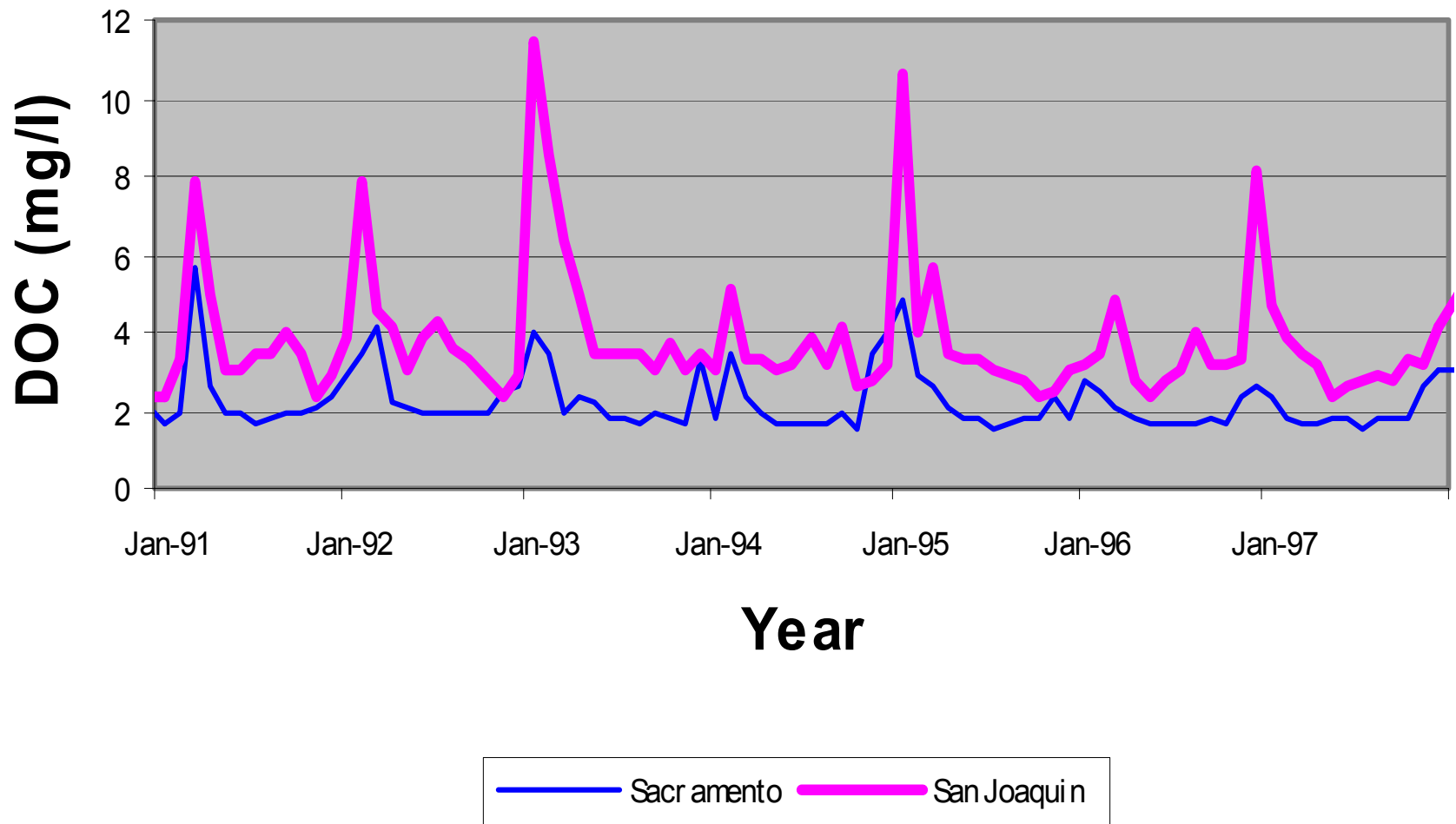- Only DOC growth inside the islands (Growth formulation is supplied to the model)

Past DOC Simulations

- Mini Validation (1993 Hydrology, DSM1)
- Comparison of CALFED Planning Alternatives (4 year DSM2 Pilot Study) (1997)
- Impact of reduction of DOC load from agricultural drains on exports (Pilot study, MWQI)
- Historical Validation (1991-1998)
- Evaluation of Planning Alternatives
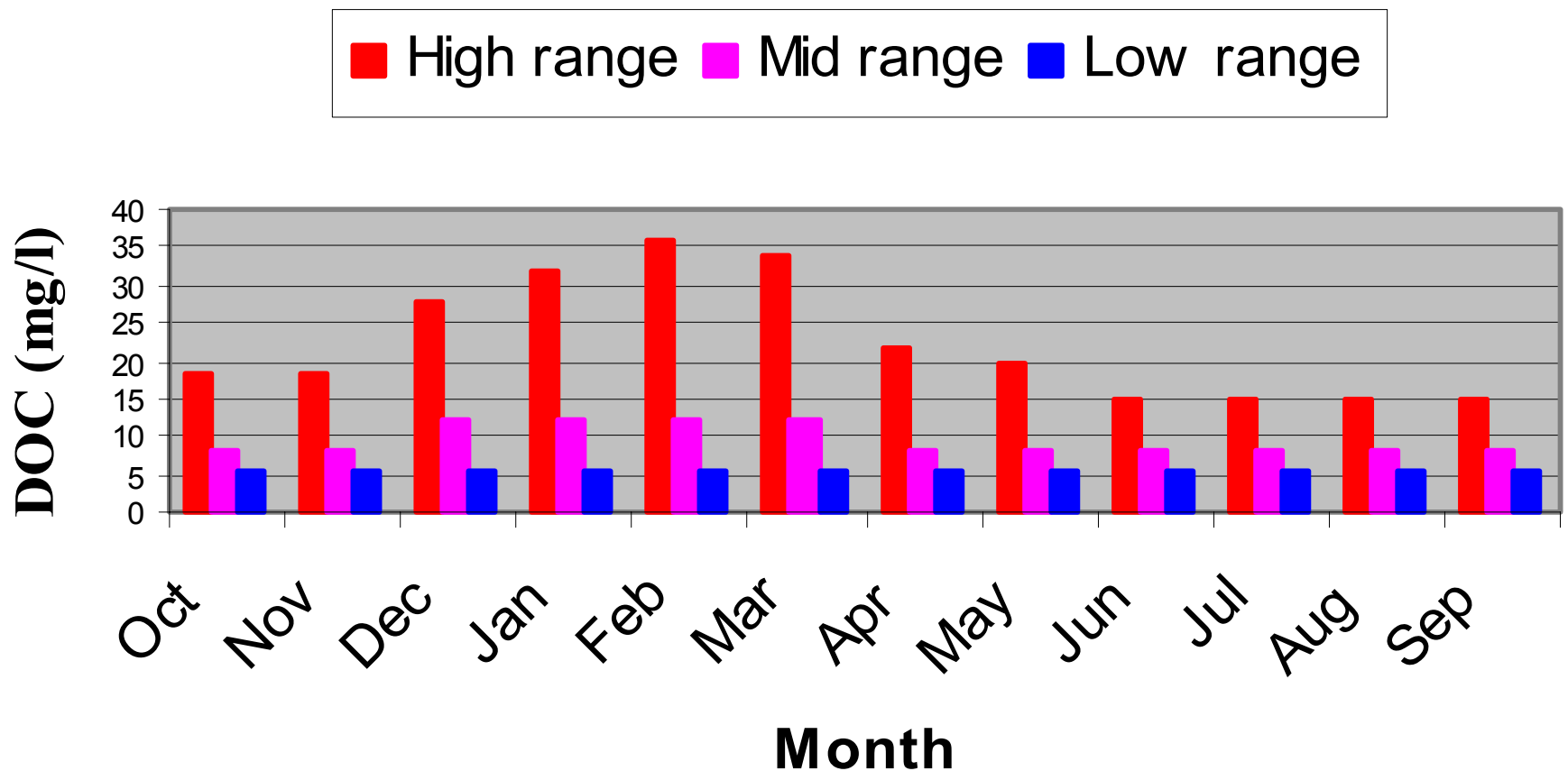 (In Delta Storage, SDIP)

Historical validation

- Data-set for DOC concentration for incoming flows provided by MWQI (Municipal Water Quality Investigations) Staff
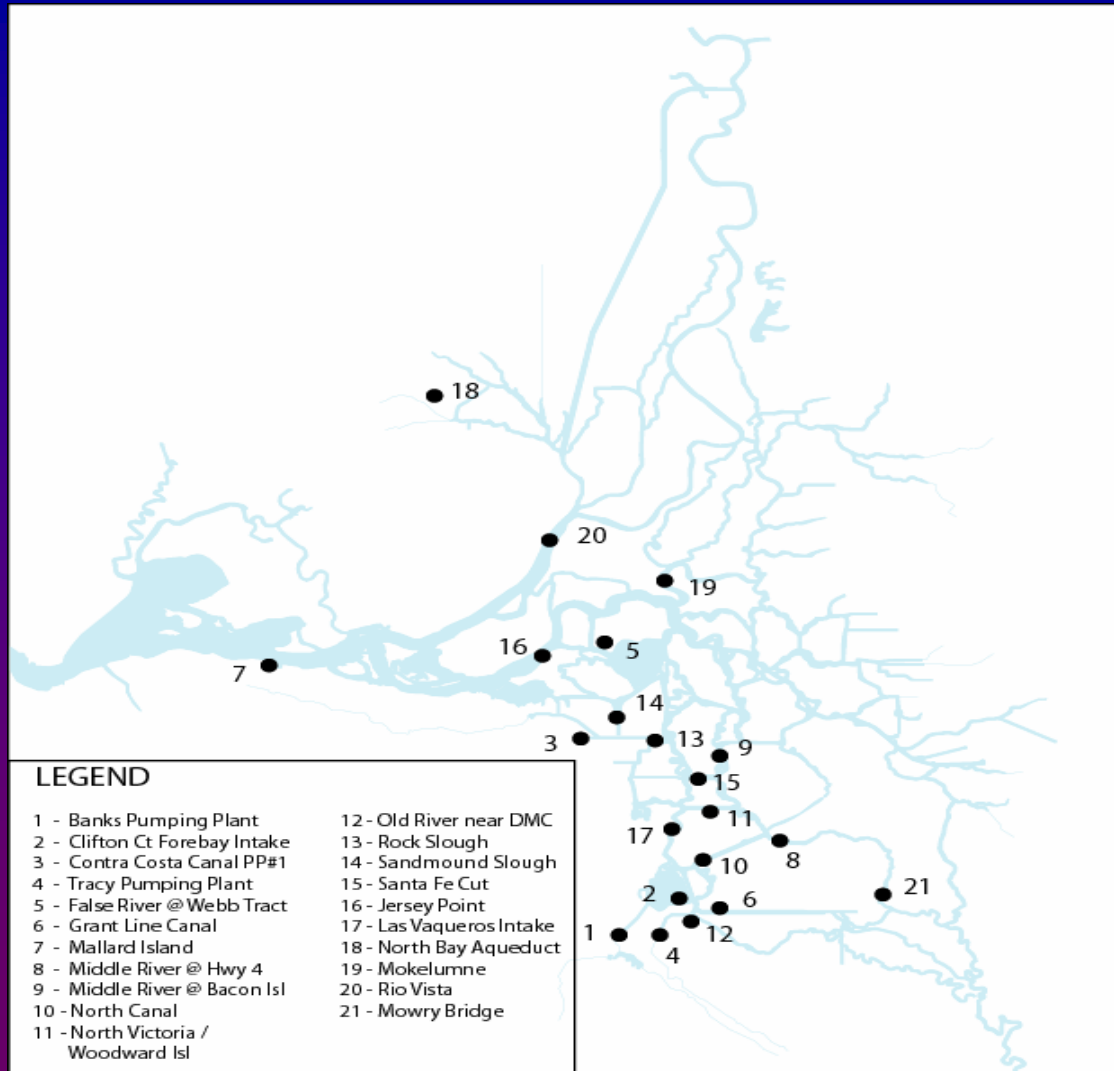
- Time period (1991-1998)

River DOC (MWQI Data)

Agricultural Drainage DOC (MWQI Data)

DOC Validation Output Locations

LEGEND

1 - Banks Pumping Plant
2 - Clifton Ct Forebay Intake
3 - Contra Costa Canal PP#1
4 - Tracy Pumping Plant
5 - False River @ Webb Tract
6 - Grant Line Canal
7 - Mallard Island
8 - Middle River @ Hwy 4
9 - Middle River @ Bacon Isl
10 - North Canal
11 - North Victoria /
    Woodward Isl
12 - Old River near DMC
13 - Rock Slough
14 - Sandmound Slough
15 - Santa Fe Cut
16 - Jersey Point
17 - Las Vaqueros Intake
18 - North Bay Aqueduct
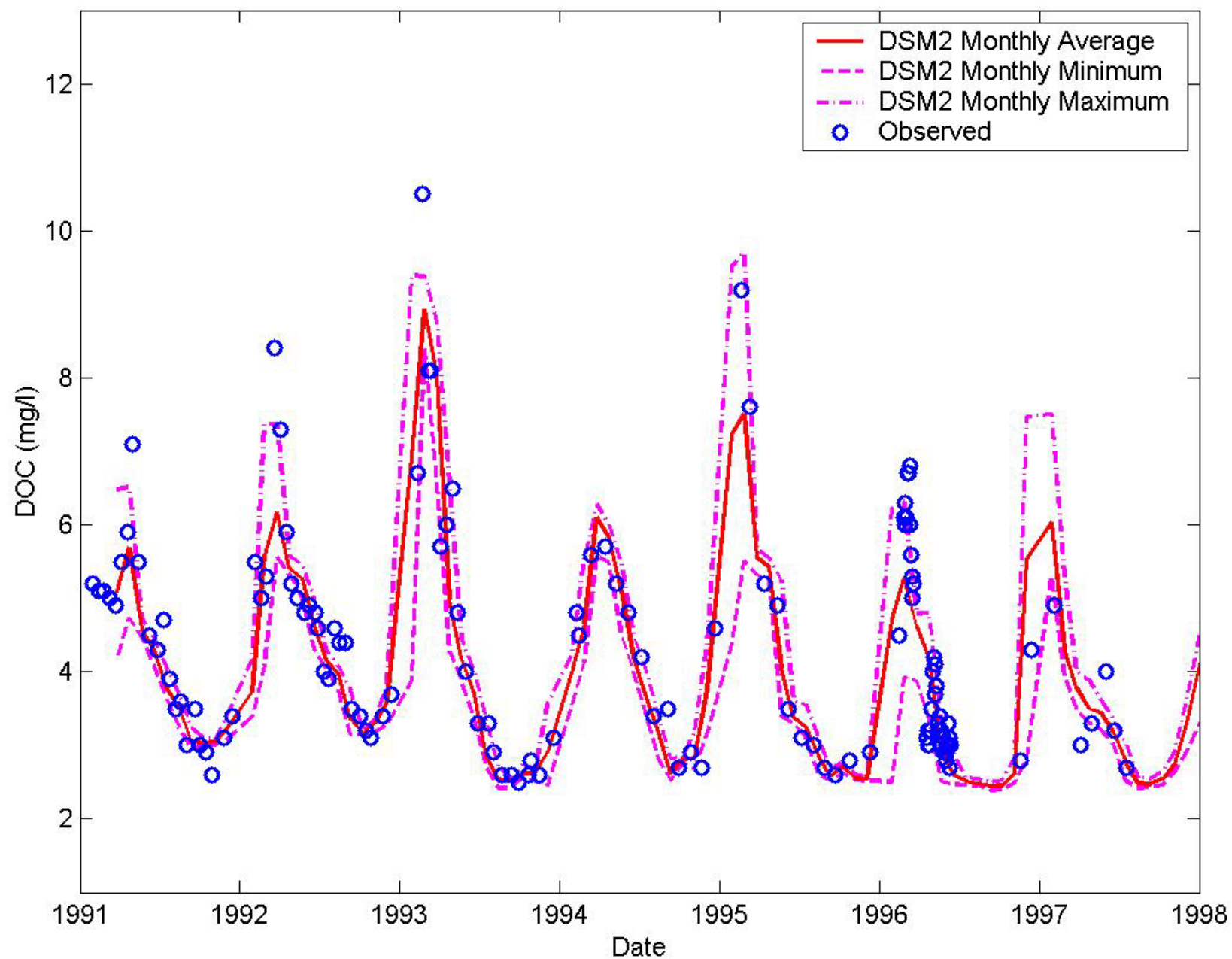19 - Mokelumne
20 - Rio Vista
21 - Mowry Bridge

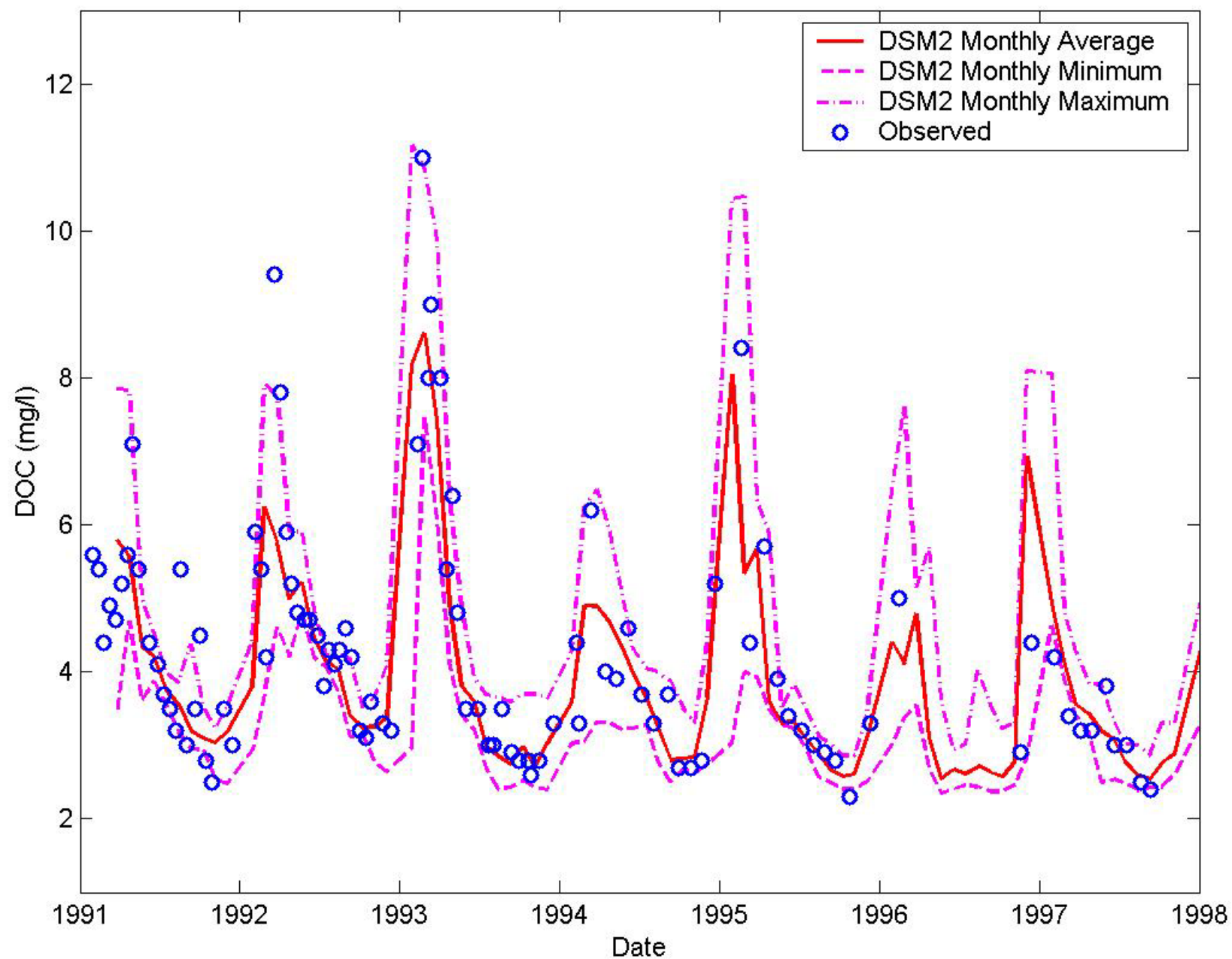- Model output compared with grab sample data at key locations in the Delta.

Difficulty:

- Model output : Time-series
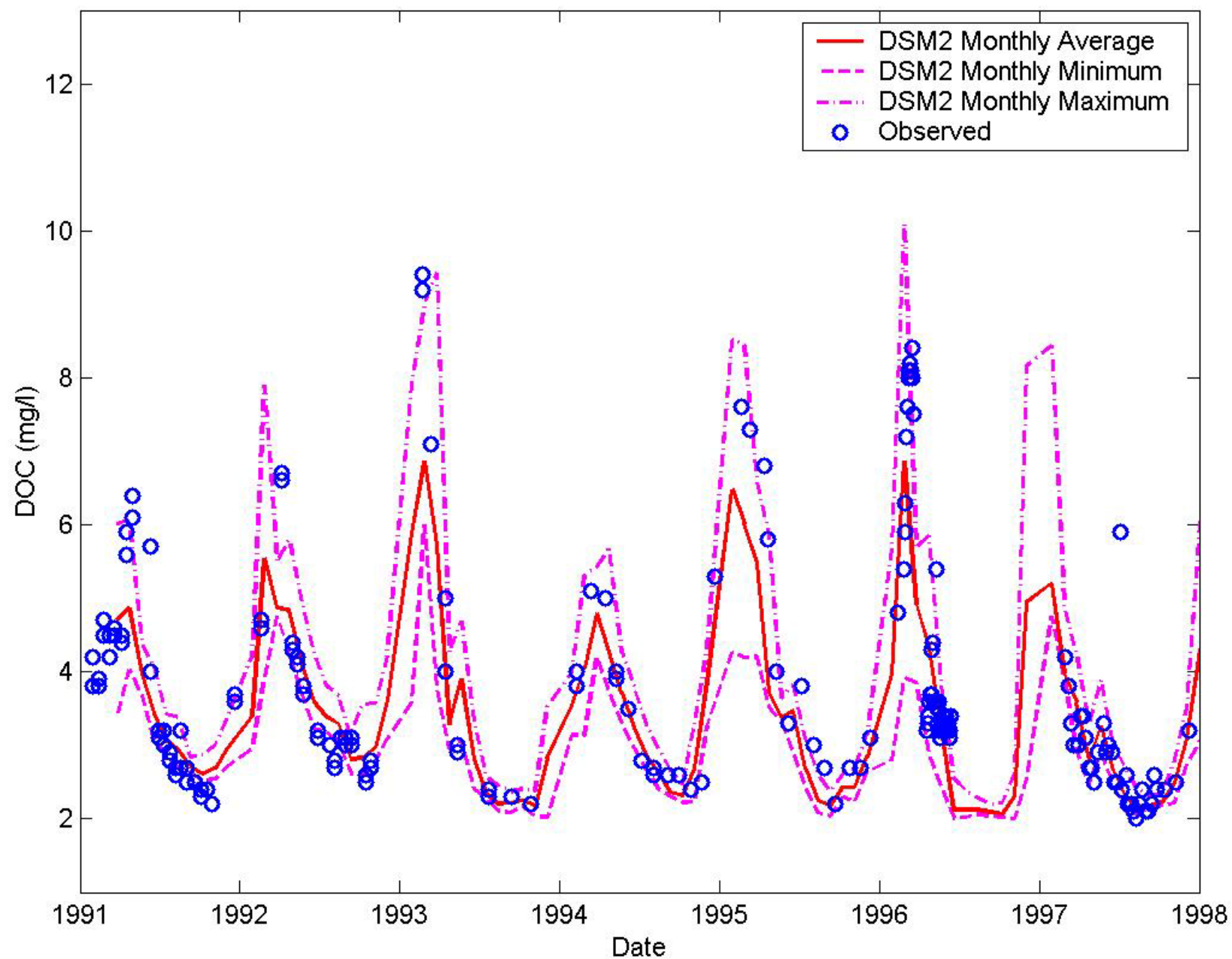- Grab sample Data : A few data points per month

Dissolved Organic Carbon at Banks Pumping Plant
Observed Grab Samples vs DSM2 Predicted Values

Dissolved Organic Carbon at Tracy Pumping Plant
Observed Grab Samples vs DSM2 Predicted Values

Dissolved Organic Carbon at Old River Rock Slough
Observed Grab Samples vs DSM2 Predicted Values

Past DOC Simulations (Cont'd)

Evaluation of Planning Alternatives

DWR-DMS Staff developed a methodology to estimate DOC concentration for all the incoming flows for the entire period.

(Hydrology 1975-1991)

Generating Boundary DOC
for
16-Year Planning Study

Data Available:

• Monthly DOC grab samples from 1987 -1997

• Daily inflows

Data Needed:

• Monthly DOC for all river flows for 1975 - 1991

Generating Boundary DOC
June - October

1) Average historic values from Jun - Oct:

       Sacramento River   1.81 mg/l
       San Joaquin River   3.38 mg/l
       Mokelumne River   1.66 mg/l

2) Use same values each year.

Generating Boundary DOC November - May

1) Observe historic relationship between flow and DOC:
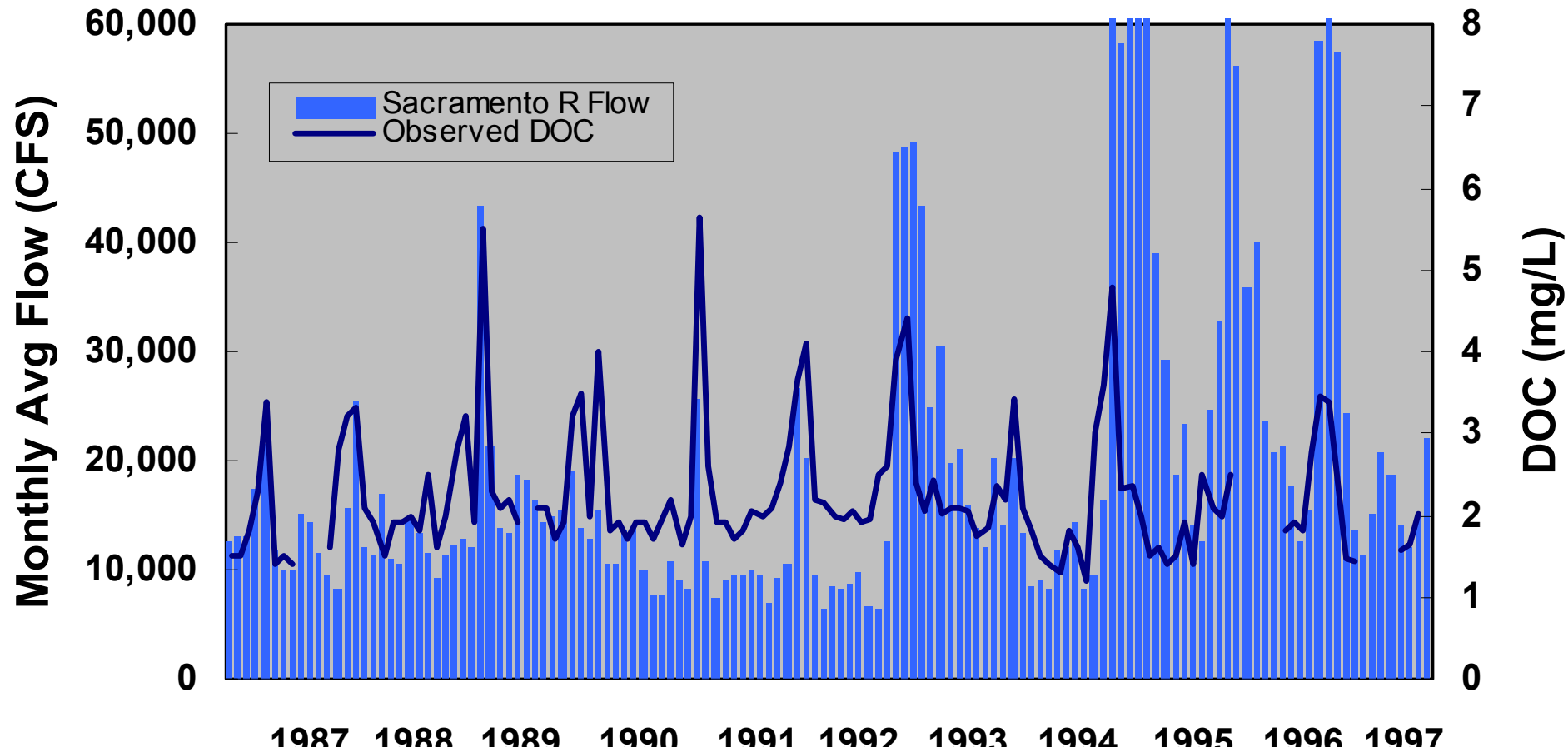
      High DOC with first high flow

      Low DOC with sustained high flow

      other periods

2) Assign DOC/flow relationship to each month in the planning period.

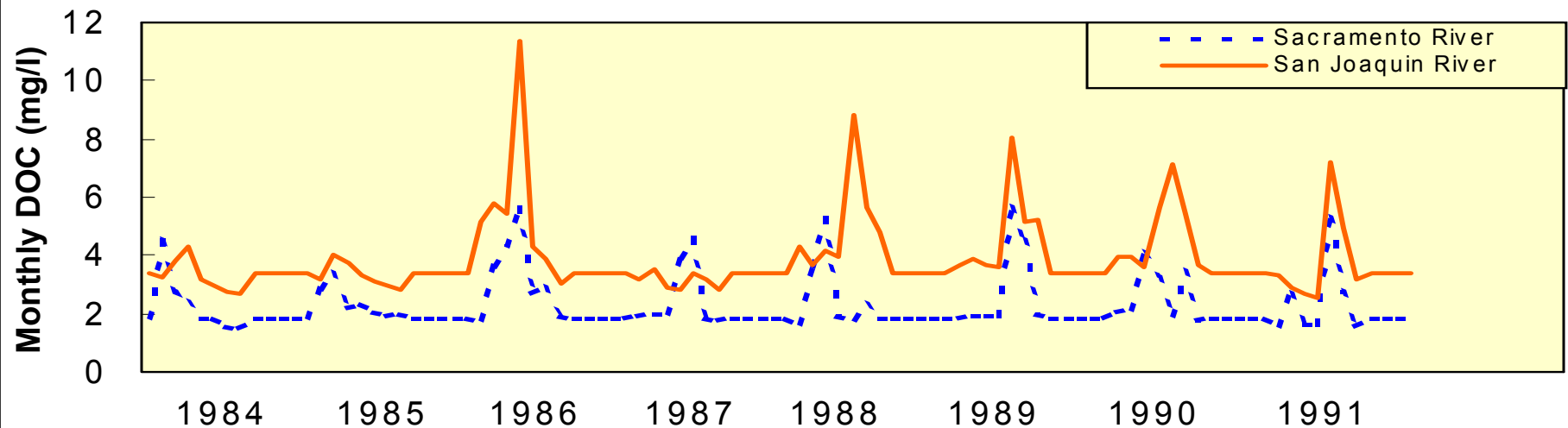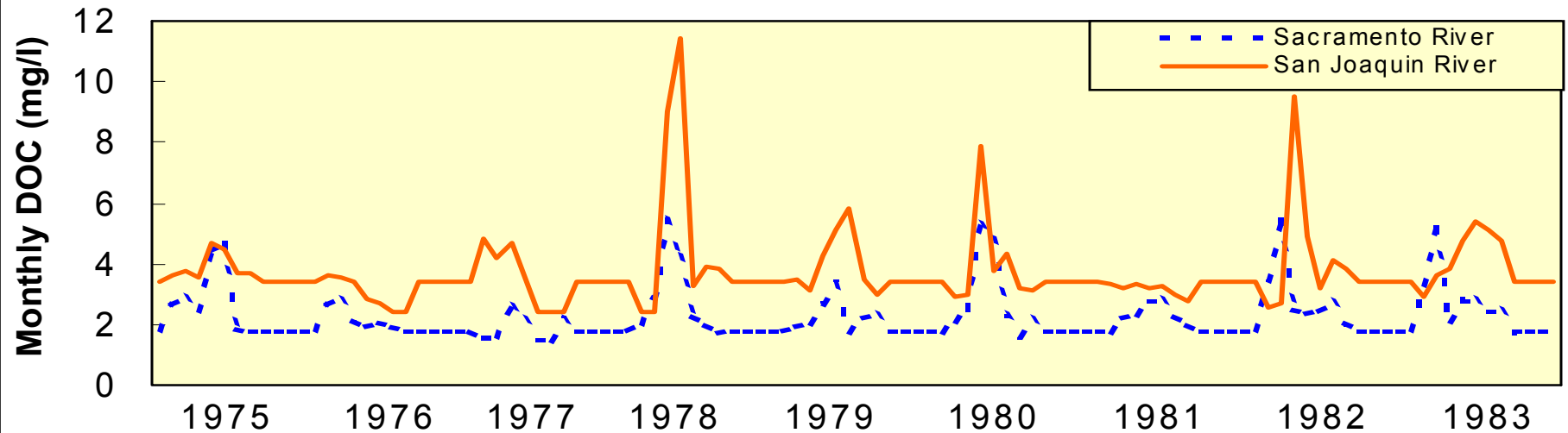# Generating Boundary DOC Historic Flow and DOC: Sacramento River

Observed DOC and Flow in Sacramento River

Generating Boundary DOC

1) Constant DOC values June-Oct each year.

2) Variable DOC for other months depending on current and previous inflows.

Generating Boundary DOC

Planning Studies Done to Date

In-Delta Storage

Results will be presented at CalFed Science

Public Workshop Wednesday August 20

8 AM- 3:30 PM   Auditorium 714 P St.

SDIP EIR/EIS

First draft of the report will be published soon

Summary

- DSM2 DOC historical validation looks reasonable

- More accurate predictions require a more comprehensive database (Need more data) (Weak Link is the DOC data and not the tool)

Additional Info on DSM2 Calibration & Validation

Flow, Stage, & EC Validation

http://modeling.water.ca.gov/delta/reports/annrpt/2001/2001Ch2.pdf
http://modeling.water.ca.gov/delta/studies/validation2000/

DOC Validation

http://modeling.water.ca.gov/delta/reports/annrpt/2001/2001Ch3.pdf

DOC Boundary Conditions

http://modeling.water.ca.gov/delta/reports/annrpt/2002/2002Ch7.pdf

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